1. Please describe the role of Region 6 in emergency response, particularly in responding to Hurricane Harvey. Please explain how this role is executed in terms of working with the state of Texas, with affected cities/counties, and in communicating with the public. Has the Region developed a list of items necessary for hurricane readiness, including air monitors?
EPA Region 6 spends substantial time coordinating, planning and exercising for large events/disasters. EPA conducts annual exercises through the Natural Disaster Operational Workgroup (NDOW) in Texas and natural Disaster Planning with Louisiana, to improve coordination between State and Federal Agencies operating under Emergency Support Functions (ESF)s 3 and 10. In a Natural Disaster response, such as Hurricane Harvey, EPA will work within Unified Command with State and Federal Partners. Our planning and exercises help to establish standard operational procedures, standardized data quality objectives, a common database system and training for effective coordination of multi-agency response to man-made and natural disasters.

   EPA Region 6 also conducts pre-landfall coordination calls with ESF 10 partner Agencies at set intervals before hurricane landfall. As the storms get within 72 hrs of landfall, R6 Regional Emergency Operations Center (REOC) begins preparing by alerting potential personnel for REOC staffing and alerting our Backup Region of potential activation for deployment. The Federal Emergency Management Agency (FEMA) will request EPA to provide Emergency Support Function-10 (ESF-10) assistance for oil and hazardous materials coordination at the State Emergency Operations Center (SEOC) and the FEMA Regional Response Coordination Center (RRCC) At the request of the State, FEMA will issue a Mission Assignment to EPA Region 6, requesting ESF-10 assistance to the State in support of assessment and response operations to actual or threatened hazardous materials and oil releases/discharge under the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

   During Hurricane Harvey, EPA rapidly responded to the State's request for support with field operations, which included but was not limited to: identification and assessment of impacts to drinking water and wastewater critical infrastructure; assistance in the implementation of the Response Manager tracking system; response to oil and hazardous materials discharges/releases; augmentation of personnel for response operations; aerial and ground assessments to identify and evaluate discharges/releases; collection and disposal of accumulations of orphaned containers; and assessment of damages to oil/chemical facilities.

2. In terms of air monitoring, please describe how this works in Texas, and to whom authority is delegated for the monitoring network.

   a. Who monitors for what types of pollutants, and how is this consolidated and tracked? Please explain if/how monitoring is divided and coordinated between the state of Texas and cities/counties.
      i. The ambient air monitoring program for Texas is delegated to the Texas Commission on Environmental Quality (TCEQ). Under the ambient air monitoring program, TCEQ monitors for ozone (O_3), particulate matter less than 10 micrometers (PM_{10}) and less than 2.5 micrometers ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and lead (Pb). TCEQ operates the Photochemical Assessment Monitoring System (PAMS) to collect air samples for oxide, nitrogen oxides, and volatile organic compound analyses.

ii. TCEQ submits an Annual Network Plan (ANP) report each July. Within the ANP, TCEQ evaluates its ambient air network design to ensure that it meets regulatory requirements in 40 CFR Part 58 and appendices. The network monitors are defined and described in the ANP.
iii. TCEQ grants or contracts air monitoring services to different organizations. The cities of Houston, Dallas, Fort Worth, and El Paso and the county of Galveston operate the air monitoring programs within their jurisdictions for the state.

b. Who is responsible for the upkeep and/or removal of the physical monitors?
TCEQ is responsible for the upkeep and removal of the physical monitors. The state has the authority to grant or contract this responsibility to others.

c. Who is responsible for bringing the monitoring system back online when it is taken down?
TCEQ is responsible for operating the ambient air monitoring system, including taking down and bringing up a monitor. This responsibility may be granted or contracted to others.

3. When the monitoring network is taken down, what data does EPA use in making decisions about air quality and public health? In the absence of data, how is risk communicated?
Should an ambient air monitoring network be unavailable, EPA relies to some degree on the historical trends within the ambient air monitoring dataset for regulatory decisions. Regulatory decisions as a result of ambient air data are based on three-year design values and short-term disruptions generally have limited effect on the design values.
- In the absence of data from a monitoring network, EPA will necessarily have limited risk information to communicate. Any air monitoring information will be based on the temporary monitoring tools described below, such as the TAGA and communications are handled through the Unified Command.

During any emergency response, EPA evaluates potential air quality risks to responders and the public and utilizes screening tools, such as hand held or deployed multi-gas monitors, EPA's Airborne Spectral Photometric Environmental Collection Technology (ASPECT) or EPA's Trace Atmospheric Gas Analyzer (TAGA) mobile laboratories. During Hurricane Harvey, EPA and TCEQ received reports and citizen complaints of possible releases and spills of hazardous materials and oil throughout the hurricane damaged areas. Initially, there were also concerns by EPA, TCEQ, and the Department of Homeland Security (DHS) over potential releases and damage to key infrastructure including large oil and chemical facilities, drinking water and waste water facilities, pipelines, refineries, Risk Management Plan facilities, and Facility Response Plan oil storage facilities. TCEQ requested EPA to aid in the assessment of these facilities for potential releases. In Response to Hurricane Harvey, the Incident Command (IC) prioritized targets for Rapids Needs Assessment (RNA). EPA utilizes multiple tools to assess the situation following a natural disaster such as Hurricane Harvey. EPA mobilized several national assets to accomplish this task.

The U.S. EPA Airborne Spectral Photometric Environmental Collection Technology (ASPECT) is an airborne platform equipped with special chemical and radiological sensors and imagery technologies. It detects chemicals while collecting aerial photos and videos for situational awareness during an incident. Chemical detection with the ASPECT system is accomplished using an open-path passive infrared spectrometer. Fundamentally, most organic compounds and some inorganic compounds have a unique IR signature (e.g., finger print). Specifically, ASPECT

uses two "bands" of IR consisting of the 3 to 5 micron and the 8 to 12 micron atmospheric windows for chemical detection. The system uses the natural IR background of the ground surface as a reference and extracts the IR signature of vapors between the aircraft and the ground. In essence, the sensor counts the number of gas molecules of the target gas between the aircraft and the ground. Detection is then automatically accomplished using a software algorithm known as background suppressed pattern recognition. This algorithm has been programmed to automatically detect, identify, and estimate concentrations for up to 72 chemical compounds. An additional 500+ chemical compounds listed in several infrared spectrometry libraries (e.g., https://secure2.pnl.gov/nsd/nsd.nsf/Welcome) can be manually assessed.

Detection limits and concentrations are derived from the sensor detection metric of "parts per million - meter (ppm-m)." This value relates a given concentration to an atmosphere that is one meter thick (e.g., assumes all the gas molecules are confined within one meter even though the aircraft has measured about 900 meters of atmosphere.) Therefore, a plume thickness must be assumed to convert (ppm-m) to concentration (ppm). In the case of ASPECT, a 10-meter plume thickness is typically assumed which is consistent with an average plume size. The ASPECT flew 28 flights over 112 hours covering miles of pipelines, 134 Risk Management Plan facilities, 456 drinking water plants and 105 waste water plants in support of the Hurricane Harvey response from August 31 to September 11, 2017. The screening level results from ASPECT were compared to the list of TCEQ short-term Air Monitoring Comparison Values (AMCVs). The screening data found no exceedances of the short-term AMCVs. ASPECT was also instrumental in monitoring and providing data to emergency responders on the ground during the Arkema explosion and fire. In addition to chemical data, aerial images (both visible and IR) were collected and provided to the Regional Emergency Operations Center (REOC) and Unified Command for situational awareness and dissemination.

For areas identified or suspected of having ambient air quality concerns, two of EPA's Trace Atmospheric Gas Analyzer (TAGA) mobile laboratories, commonly referred to as TAGA buses, were deployed to assist in response activities. The TAGA is self-contained and is capable of real-time monitoring of outdoor air. The TAGA lab monitored the air in the vicinity of approximately 25 facilities and adjacent neighborhoods in the impacted areas from September 5 - 20, 2017. The TAGA covered more than 640 miles in conducting the air monitoring. No monitored readings exceeded the TCEQ AMCV short-term screening levels.

4. What types of backup monitoring plans are in place for facilities when the monitoring network is taken down due to the hurricane? Are these built into SIPs?
   There are no regulatory requirements that require States to implement monitoring plans during or in the aftermath of hurricanes. States are required to meet certain data completeness requirements and an extended shutdown of monitors could impact their ability to meet the completeness requirements. In addition, the Texas SIP does not require the monitoring network to operate during hurricanes or in the aftermath nor is the SIP required to have back up monitoring plans for such events. Given the high winds, flooding, impaired access and loss of power prevalent during major hurricanes, it would be impractical to have a back-up monitoring network. Instead targeted temporary monitoring approaches such as the ASPECT on TAGA allow some information to be collected in priority areas.

5. How was air quality data communicated to the public during and after Hurricane Harvey?

a. If a facility communicated a spill or accidental emission to the Region or Texas, how was the communication of this event disseminated to surrounding communities?
All release/spill reports to the National Response Center are also transmitted to State and local officials. For example, a release that occurs in Harris County, TX and reported through the National Response Center to EPA Region 6 is also transmitted to: Harris County Fire Marshal's Office (Emergency Operations Hazmat Division), Houston Police Department, Port Of Houston Authority Police Department, Port Of Houston Authority Police Department, Railroad Commission Of Texas (Pipeline Safety), TCEQ (Region 12), Texas Fusion Center (Counter Terrorism), TX Department of State Health Services (Command Center), TX General Land Office (TXGLO Region 2), And Texas State Operations Center (Command Center), who can make decisions about public safety.

b. How are decisions regarding evacuations or shelter in place orders made for air events during and after a disaster?
Decisions about evacuations or shelter in place are under the authority of local Officials. There are many Federal and Industry group guidance documents out that provide guidance on evacuations based on chemical concentrations or types of chemicals involved in an emergency. The Department of Transportation's Emergency Response Guidebook (ERG) is widely adopted in the Emergency Response and Public Safety communities. Also, EPA has sponsored software, such as CAMEO (Computer-Aided Management of Emergency Operations), and ALOHA (Which is the hazard modeling program for the CAMEO® software suite, which is used widely to plan for and respond to chemical emergencies). State and local authorities may also use the Interagency Modeling and Atmospheric Assessment Center (IMAAC) to develop plume models to support their decisions. Additionally, there are many publications from FEMA, American Red Cross, and other entities on evacuation / shelter in place that support local emergency management. EPA can provide support through air monitoring to and advice.

c. How are the best mechanisms and necessary languages for information provision determined for communicating to impacted communities?
Each community must determine the most appropriate and effective means of providing information to citizens within their community. This may include: Reverse 9-1-1 systems which can call home / cell phones in a prescribed area with emergency information; outdoor sirens; systems to notify all cell phones within a prescribed area (such as Everbridge, Nixle); community hotlines (such as 826-INFO in Corpus Christi, 1-877-THE-STAN in Southeast TX, and 281-476-CAER (2237) in the Houston Ship Channel area; and door-to-door notifications by first responders. Each community must also determine the appropriate languages to transmit information based on the demographics of their community. This is process is updated and refined routinely prior to an actual emergency. Coordinating through Unified Command, EPA assisted in providing fact sheets in English, Spanish, and Vietnamese to the local citizens through County Emergency Operations Centers (EOCs).

6. How is the decision made to conduct ASPECT monitoring or to bring in the TAGA buses?
EPA utilizes multiple tools to assess the situation following a natural disaster such as Hurricane Harvey. EPA mobilized several national assets to accomplish this task. The ASPECT aircraft is part of Consequence Management Advisory Team (CMAT) and the TAGA mobile air monitoring buses

are under the Environmental Response Team (ERT). ASPECT had been prearranged to be on Standby for the Hurricane Harvey Response. TAGA was requested and mobilized on August 29, 2017, due to widespread impacts to the petroleum and chemical industry along the coast.

a. Please explain the process by which these monitoring types are used, who in EPA controls their transit and operation, and how the operations of ASPECT and TAGA are fed into the command control center during and after the hurricane. If possible, please provide a timeline for the provision of the ASPECT plane and TAGA buses to the disaster area.
For Hurricane Harvey, the Unified Command (IC) prioritized all targets for subsequent collection. In addition to chemical data, aerial images (both visible and IR) were collected and provided to the Regional Emergency Operations Center (REOC) for situational awareness and dissemination. The Texas Commission on Environmental Quality (TCEQ) Toxicology Division (TD) through the Environmental Unit established a short-term health-based air monitoring comparison values (AMCV) for evaluating air monitoring data. It may not be not appropriate to compare ASPECT results or other air sampling results (e.g., 24- hour canister sample) to the short-term AMVC since the short-term AMCV is based on a one-hour exposure scenario. However, a comparison can be made to help decide where to deploy limited ground-based resources to assess potential chemical exposures in the area. The ASPECT aircraft is housed in Addison TX, and if it is at base, can usually be airborne in about an hour. TAGA buses had to be driven from other Regions and required 2-3 days mobilization to the Houston area.

b. When were these monitoring types conducted, and how long after the hurricane hit was this? How long were these mobile monitoring operations conducted, and were they able to conduct monitoring at all locations impacted by the hurricane?
On August 28, 2017, EPA received a Mission Assignment from FEMA for ESF-10 assistance to the State of Texas. August 29, 2018, 4 Region 6 IMT members deployed to Corpus Christi to establish a Unified Command with TCEQ, TGLO & USCG. August 29, 2017, EPA Region 6 requested CMAD mobilize the ASPECT aircraft and ERT mobilize the TAGA mobile air monitoring platform and respond to support Region 6 in their response to the impacts of Hurricane Harvey. Hurricane Harvey adversely impacted more than 5,000 square miles and the ASPECT quick chemical monitoring/screening capabilities can be used to help decision makers make more efficient use of ground-based assets to ensure human health and the environment are protected. During the response air monitoring was conducted in all three Branches of operations.

c. How were determinations made regarding where to conduct monitoring, by which mobile monitor type, and what input was factored into this decision-making process?
From an operational perspective, ASPECT is a screening tool. It provides information that a chemical compound (in vapor phase) has been detected with an approximate location and its estimated concentration. It does not provide the altitude of where the gas was detected. For emergency response purposes, the most conservative assumption is to assume all the gas is in the breathing zone. Accordingly, ASPECT is one component and does not replace ground-based monitoring, where more sensitive instruments can be deployed to assess ground-based air concentrations.

When areas were identified that needed assessments of ground based air concentrations, TAGA was utilized to provide this monitoring. EPA conducted ambient air monitoring in the neighborhood adjacent to the Valero refinery in southeast Houston, as well as multiple other industrial facilities in all three Branches.

Beginning on September 5, 2017, the first TAGA bus began monitoring the perimeter and selected roads in the neighborhood adjacent to the Valero Refinery in Houston. Low level benzene concentrations (approximately 1-2 part per billion by volume (ppbv)) were observed at many locations. Additional field personnel deployed to support air monitoring efforts and accompanied the TAGA to the Manchester area, where strong odors had been reported. Air Enforcement staff reviewed available monitoring data as it came in and compiled a targeting list of facilities in the vicinity of any elevated concentrations. That list was later expanded to include those facilities that had submitted Force Majeure requests to their consent decrees, as well as those reporting excess emissions in Texas' STEERS system. They converted the targeting list into a recommended monitoring schedule and path for the TAGA and transmitted that to the Unified Command. The TAGA monitored the Baytown area on September 15, 2017, and the Texas City and Sweeny areas on September 17, 2017. The Second TAGA bus arrived in Houston on September 18, 2017. The teams then divided into two groups with one TAGA team monitoring around Corpus Christi, and the second TAGA team going to Port Arthur. TAGA operations were completed and assets were demobilized on September 21, 2017.

d. How are these data types used in making decisions about public health?
The ASPECT and TAGA served as initial screening tools to help the field responders make more informed decisions based on actual measurements. The screening level results from ASPECT and TAGA were compared to the list of the short-term Air Monitoring Comparison Values (AMCVs) from the Texas Commission on Environmental Quality (TCEQ). The screening data found no exceedances of the short-term AMCV compounds.

e. How do Air Monitoring Comparison Values (AMCL) relate to Acute Exposure Guidelines (AEGL), and how are these two used to determining the safety of the air?
Both the TCEQ AMCVs and EPA AEGLs are used to assess air monitoring data. These values are not used in air permitting. AEGLs represent threshold exposure limits (exposure levels below which adverse health effects are not likely to occur) for the public and are applicable to emergency exposures ranging from 10 minutes (min) to 8 hours. Three levels—AEGL-1, AEGL-2, and AEGL-3—are developed for each of five exposure periods (10 min, 30 min, 1 h, 4 h, and 8 h) and are distinguished by varying degrees of severity of toxic effects.

AMCVs are comparison values used in TCEQ's evaluation of ambient air monitoring results to assess the potential for measured concentrations of specific chemicals to cause health effects. Similar to TCEQs Effect Screening Levels (ESLs), AMCVs are chemical-specific air concentrations set to protect human health and welfare from potential cumulative and aggregate exposures to ambient air. AMCVs are used to determine if there is a potential concern.

They are set at levels below levels expected to cause adverse health effects so, even if concentrations of a contaminant are somewhat above the AMCV, adverse health effects are not expected. These values can be used to inform several different potential courses of action depending on the results. They can indicate the need for additional monitoring, or if targeted monitoring is needed.

f. How were the results from ASPECT and TAGA bus monitoring communicated to TCEQ, affected counties, and the public?
The results from the ASPECT and TAGA were communicated to TCEQ and the counties through the Unified Command for the Hurricane Harvey response. The results from the ASPECT and TAGA were also communicated to the public through the EPA public website.

7. Please discuss the startup, shutdown, and malfunction waiver process for disasters.
    i. TCEQ is delegated the responsibility for SSM waivers.

8. In terms of air monitoring after Hurricane Harvey, please touch on how well you feel Region 6, TCEQ, and cities/counties carried out their responsibilities, and any areas of strength or weakness in carrying out their responsibilities.
Every natural disaster presents unique challenges. Hurricane Harvey hit Corpus Christi Texas as a category 4 hurricane, then lingered over the Texas gulf coast dropping more than 50 inches of rain in Harris County, according to the National Weather Service, and affected over 7 million people. EPA employed assets during the Hurricane Harvey response to assist with response efforts that were not available elsewhere. EPA often responds to reports of environmental impacts from plumes, or air emissions that may be dangerous to the community. In response to complaints of odors and fumes from petroleum plants following Hurricane Harvey, EPA deployed the Trace Atmospheric Gas Analyzer, or TAGA bus. This is a mobile air pollution detection vehicle that can provide air quality results quickly by collecting constant, real-time data for outdoor air quality. The TAGA lab monitored the ambient air near approximately 25 facilities and adjacent neighborhoods, covering over 640 miles. The TAGA buses were able to detect actionable emissions or confirm that there was nothing of concern.

Given the magnitude of this disaster, TCEQ did a remarkable job of bring down one of the biggest monitoring networks in the country and moving it out of harm's way. When the storm was over and sites were accessible, TCEQ began bringing sites back on line. TCEQ was able to begin bringing monitors back online as early as August 30, 2017, in Corpus Christi, on August 31 in Houston, and September 2nd in Beaumont. It is important to remember, if the monitoring network had been left online and been damaged by the storm, the ambient air monitoring network could have been unavailable for a longer period.

9. In terms of communication with the public after Hurricane Harvey, please touch on how well you feel Region 6, TCEQ, and cities/counties carried out their responsibilities, and any areas of strength or weakness in carrying out their responsibilities.
EPA Region 6 maintained a Website, [HYPERLINK "https://response.epa.gov/Hurricaneharvey2017"], with publicly available information, as well as issuing News Releases about ongoing operations and conditions and providing Facts Sheets through our Community Liaisons and State and local Officials.

10. What were the biggest challenges in responding to Hurricane Harvey? How can these be better addressed in responding to future disasters?
    When activated during a large-scale disaster, infrastructure impacts are always an impedance to a response. Impacts from road blockages to cell phone towers being down must be overcome. Due to so many residents being displaced and the large number of responders converging on the area, housing for our responders has been a big issue we have had to overcome.